

NITIDULIDS (COLEOPTERA: NITIDULIDAE) ASSOCIATED WITH CHINESE CHESTNUTS^{1,2}

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ABSTRACT: An unusual growing season in 1977 caused many Chinese chestnuts, *Castanea mollissima* Blume, to split open at harvest time in NE Ohio. This allowed easy access by sap beetles (Coleoptera: Nitidulidae) and enabled them to enter open burs and feed on nuts with split shells. Fifteen species of sap beetles, including three subfamilies, were encountered feeding on nuts and causing extensive damage. Subsequent tests proved that Chinese chestnuts are attractive to one species of sap beetle encountered in this study.

Sap beetles (Coleoptera: Nitidulidae), that are general feeders, are often attracted to ripe, overripe and decomposing fruits and vegetables (Williams et al. 1983). Payne and Johnson (1979) do not mention sap beetles as pests of Chinese chestnuts, *Castanea mollissima* Blume, and we cannot find any other publication which does. Nuts and peanuts are listed as hosts of *Carpophilus hemipterus* (L.), but no reference to chestnuts is made (Hinton 1945). Dr. J.A. Payne of the Southeastern Fruit and Tree Nut Research Station at Byron, GA (pers. com. 1978) mentioned that sap beetles are often found in weevil-infested chestnuts; however, they are secondary pests following weevil infestations.

Prompted by complaints from several chestnut growers in NE Ohio in the fall of 1977, investigations were launched to determine the cause of feeding damage to the nuts.

Survey of sap beetles

Fifty bur samples of Chinese chestnuts were collected from the orchard floor in both Wayne and Medina Counties. Burs were gently picked up and quickly placed in double plastic bags, to prevent fast moving arthropods from scampering away in the ground cover. As soon as samples were collected, plastic bags were sealed. Samples were returned to the laboratory and examined for insects. As insects were encountered, they were placed in vials containing 70% alcohol. Due to the difficulty of removing insects from the nuts inside the burs, entire burs were shaken vigorously in a shallow pan

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to agitate and dislodge all insects. Collections were labeled and sent to specialists for identification of the nitidulids in this study (Table 1).

The first group of nuts examined showed signs of insect feeding only in nuts with split shells which were in partially opened burs. When the burs were intact, there were no insects and no damage. Insect feeding on nuts with split shells made them unfit for sale. The gnawed areas of the nuts resembled mouse damage. There was a sawdust-like powder in the bottom of the container recognizable as frass from insect feeding.

August and September of 1977 were unseasonably wet, with over 4 inches more rain than usual. This exceptionally wet period was followed by a dry spell, apparently causing fruits and nuts to split open, thereby allowing insects easy access.

Samples were comprised of a diverse group of sap beetles. Among them were specimens of *Stelidota geminata* (Say), an important strawberry pest that currently is being studied. A wide range of nitidulids from diverse habitats responded to fallen Chinese chestnuts under field conditions.

Most of the species of sap beetles represented in Table 1 are common to woodland habitats (Dorsey and Leach 1956) but several, such as *Carpophilus hemipterus*, *C. lugubris* Murray, *Stelidota geminata* (Say), *Omosita colon* (L.) and *Glischrochilus quadrisignatus* Say, occur in a variety of habitats. For example, *C. hemipterus*, *O. colon* and *Glischrochilus fasciatus* (Olivier) are recognized as stored product pests (Hinton 1945). Only seven species of sap beetles (*C. hemipterus*, *C. lugubris*, *C. corticinus*, *C. brachypterus*, *G. quadrisignatus*, *G. fasciatus*, and *S. geminata*) have been regularly collected in our traps of decomposing fruit or fermenting baits in orchards and fruit growing areas in northeastern Ohio. Chinese chestnuts attracted twice that many species in a single season in the same area of Ohio.

The three most abundant nitidulids accounting for 85% of the specimens are all established pest species. The dusky sap beetle, *Carpophilus lugubris*, has been responsible for the refusal of sweet corn by canners (Luckmann and Hibbs 1959). The picnic "sap" beetles, *Glischrochilus fasciatus* and *G. quadrisignatus*, severely attack the fruit of everbearing strawberries and raspberries as well as being nuisance pests at picnics and other outdoor gatherings where food is served (Williams et al. 1981). *Glischrochilus quadrisignatus* has recently been incriminated in transmission of corn ear rot (Attwater and Busch 1983).

Attractance of nuts and extract to *S. geminata* (Say)

To determine comparative attractancy of Chinese chestnuts to *Stelidota geminata*, an experiment was set up in the laboratory. Six treatments

consisted of five possible attractants (banana the standard) and a control. Treatments were as follows: (1) whole nuts (composed of ground whole nuts in water without shell (pericarp) and bur (involucure)), (2) water extract of nut (liquid portion only), (3) whole banana (banana pulp blended in water), (4) water plus sugar, (5) hexane extract of nut, and (6) water (check). Each candidate was placed in an inverted plastic vial lid 2.5 cm in diameter. One ml of each potential attractant was used. The hexane and water extracts of the nut were applied to a disc of germination paper in the lid and allowed to air dry before testing. Water plus sugar and water were applied to germination paper just prior to testing as were whole nut and whole banana. Thus, the latter four were moist/wet when tested. The arena used for the tests was a plastic container 25.5 cm in diameter by 9 cm deep covered with a vented plastic lid. All six treatments were placed in an arena in the form of a circle, 9 cm from the center and equidistant from each other (ca. 7 cm apart). Thus, looking at the configuration of the treatments from above it appeared as a 6-pointed star. This experiment was replicated 10 times with the treatments being positioned randomly. Fifty beetles of unknown age and sex from laboratory cultures were placed in the center of the arena in an open shell vial and allowed free choice for 24 h. Arenas were placed in a lighted environmental chamber at $70 \pm 5\%$ RH and $23 \pm 2^\circ\text{C}$. At the termination of the test the number of beetles on or within 1 cm of a lid were recorded.

Data analyses for all catches were analyzed by analysis of variance and means separated using Duncan's new multiple range test (Duncan 1955).

In a laboratory experiment, attraction to the nuts of Chinese chestnuts was evaluated for *Stelidota geminata* which we had in culture. Whole nut and water extract of nut were significantly more attractive than other treatments (Table 2). Portions of the attractant were present in the water extract but apparently not in the hexane extract. Banana is a superior nitidulid lure and was chosen as the standard in this research. McMullen and Shenfelt (1961) collected more than 10,000 specimens in a forested area of Wisconsin in a single growing season using banana bait. It is interesting that we did not observe more response to whole banana in our tests. This study indicates that *S. geminata* is strongly attracted to Chinese chestnuts.

Rearing *S. octomaculata* on Chinese chestnuts

Stelidota octomaculata (Say), which was not encountered in our studies, is common to northeastern woodland habitats. This species has not been taken at fruit baits in Ohio, and Frost and Dietrich (1929) did not collect *S. octomaculata* in Pennsylvania, but it is commonly collected from leaf litter in Ohio in early spring. This species was reared with difficulty

until we offered Chinese chestnuts as a food. The colony, which had been on a decline, responded immediately with the addition of chestnuts. *S. octomaculata* was reared successfully for over a year with Chinese chestnuts as the only food.

We do not wish to infer that all species of sap beetles mentioned herein are injurious to exposed chestnuts. Laboratory feeding studies did confirm that *C. hemipterus*, *S. geminata*, and *S. octomaculata* were able to feed on chestnuts as adults and their larvae fed and prospered on this food source. It is inferred that such field collected nuts did contain a wide variety of sap beetles when sampled. We would hypothesize, based on laboratory experiments with one of the group, that Chinese chestnuts contain a water soluble attractant which appears to be attractive to a wide range of Nitidulidae in three subfamilies.

Table 1. Nitidulids found with Chinese Chestnuts in Medina and Wayne Counties, Ohio October 1977¹.

Subfamily	Number Specimens	Scientific Name
CAROPHILINAE		
	1	<i>Colopterus niger</i> (Say)
	2	<i>Colopterus semitectus</i> (Say)
	1	<i>Colopterus truncatus</i> (Randall)
	13	<i>Carpophilus corticinus</i> Erichson
	2	<i>Carpophilus hemipterus</i> (Linné)
	59	<i>Carpophilus lugubris</i> Murray
	1	<i>Carpophilus sayi</i> Parsons
NITIDULINAE		
	1	<i>Omosita colon</i> (Linné)
	1	<i>Epuraea rufa</i> (Say)
	4	<i>Stelidota geminata</i> (Say)
	7	<i>Amphicrossus ciliatus</i> (Olivier)
CRYPTARCHINAE		
	1	<i>Cryptarcha concinna</i> Melsheimer
	30	<i>Glischrochilus fasciatus</i> (Olivier)
	128	<i>Glischrochilus quadrisignatus</i> (Say)
	4	<i>Glischrochilus sanguinolentus</i> (Olivier)
	255	TOTAL

¹Other families of Coleoptera represented in the collections were: 1 specimen of Cryptophagidae; 3 specimens of Staphylinidae; and 1 specimen of Curculionidae.

Table 2. Laboratory evaluation of attractancy of nuts of Chinese chestnuts to *Stelidota geminata*, Ohio 1978.

Lures	Mean number beetles attracted after 24h ²
Whole nut (ground nut in water)	31.3 a
Water extract of nut	13.5 b
Whole banana in water ¹	1.0 c
Water + sugar	0.5 c
Hexane extract of nut	0.0 c
Water (check)	0.0 c

¹Banana is one of the better attractants for *S. geminata* in field studies.

²Means followed by the same letter are not significantly different according to Duncan's New Multiple Range Test ($P < 0.05$ level).

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